

## CLAIMS

1. A loop antenna device (10, 20, 30) for a portable device (1), the antenna device (10, 20, 30) comprising an antenna loop (11, 21, 31) of conducting material having first and second ends to be connected to radio frequency (RF) circuitry and a ground plane of a PCB (16, 26, 36), respectively, the antenna loop being positioned opposite said ground plane, characterized in that the loop antenna device (10, 20, 30) further comprises a ground plane extender (17a, 17b, 27a, 27b, 37a, 37b) positioned at a first side of the PCB (16, 26, 36), and in a longitudinal extension of the ground plane.

2. The loop antenna device according to claim 1, wherein the ground plane extender is a battery casing.

3. The loop antenna device according to claim 1 or 2, wherein the antenna loop comprises first and second connectors (15a, 15b, 25a, 25b, 35a, 35b) provided at a second side of the PCB (16, 26, 36) opposite said first side for connecting the antenna loop (11, 21, 31) to the RF circuitry and the ground plane of the PCB (16, 26, 36), respectively.

4. The loop antenna device according to any of the previous claims, wherein the antenna loop (11, 21, 31) further comprises:

a first portion (12) having a first and a second end, said portion (12, 22, 32) extending in a first direction along a third side of the PCB (16, 26, 36), the first end being connected to the RF circuitry of the PCB (16, 26, 36);

a second portion (13, 23, 33) having a first and a second end, the first end of the second portion (13, 23, 33) being connected to the second end of the first portion

(12, 22, 32), said second portion extending in a second direction from the third side of the PCB (16, 26, 36) towards a fourth side thereof, which is opposite said third side; and

5           a third portion (14, 24, 34) having a first and a second end, the first end of the third portion (14, 24, 34) being connected to the second end of the second portion (13, 23, 33) and the second end of the third portion (14, 24, 34) being connected to the ground plane of the PCB (16, 26, 36), said third portion (14, 24, 34) extending in the  
10           opposite direction of said first direction along said fourth side of the PCB (16, 26, 36).

5. The loop antenna device according to any of the  
15           previous claims, wherein the PCB (16, 26, 36) is a multi-layer PCB having one layer used as a dedicated RF ground plane, which also provides the ground plane of the antenna device (10, 20, 30).

20           6. The loop antenna device according to any of the previous claims, wherein the antenna extender is at least one battery casing (17a, 17b, 27a, 27b, 37a, 37b) of a battery cell having a position to serve as an extension of the ground plane of the PCB (16, 26, 36).

25           7. The loop antenna device according to any of the previous claims, wherein the antenna loop (11, 21, 31) is positioned opposite a first or a second surface of the PCB (16, 26, 36).

30           8. The loop antenna device according to any of the previous claims, wherein the conductive material of the antenna loop (11, 21, 31) is metal.

9. The loop antenna according to claim 7, wherein the antenna loop (11, 21, 31) is a U-shaped dielectric having the antenna shape etched into the dielectric.

5        10. The loop antenna device according to claim 5 or 6, wherein the antenna loop (11, 21, 31) is provided inside the PCB (16, 26, 36).

10       11. The loop antenna device according to any of the previous claims, wherein a bezel (28, 38), which is connected to the PCB, extends from the third side of the PCB (26, 36) towards the fourth side of the PCB, and/or bezel flanges (39a, 39b) connected to said ground plane extends along the third and fourth sides of the PCB.

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12. A multi-layer printed circuit board (PCB), characterized by a loop antenna device according to any of the claims 1-11.

20       13. A portable communication device, characterized by a loop antenna according to any of the claims 1-11.

14. The portable communication device according to claim 13, wherein the apparatus is a headset (1).

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